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Larry M. DeBrock

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NO. 18



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Joint Marketing Efforts and Pricing Behavior

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Abstract

Many industries exhibit the phenomenon of joint marketing efforts: each firm sells not only its own goods but also goods of its various rivals. In effect, these "temporary joint ventures" involve sharing of the marketing duties under some pre-arranged compensation scheme. This paper investigates the phenomenon of such joint marketing by non-cooperative rivals. The results indicate that such arrangements lead to prices above the competitive level, perhaps approaching the collusive level, even though the rivals continue to act non-cooperatively.

I. INTRODUCTION

Recent research into oligopolistic markets has emphasized the importance of behavioral rules, often referred to as facilitating practices.¹ These behavior patterns, whether formal or informally structured, can be shown to have very real (and often anti-competitive) results.² This paper will consider a similar phenomenon, the practice of interfirm marketing arrangements.

A common example of this type of behavior exists in the operation of modern residential real estate markets. Buyers and sellers of residential real estate usually arrange for intermediaries to aid them in their transactions. These intermediaries, real estate agents, provide the consumer with expertise and advice, in addition to serving as a collection house for market information. The fact that the buyer and seller usually have different real estate agents opens up a fascinating collection of agency problems. This paper will consider one such problem: there may exist some degree of inter-agent cooperation in marketing.

Most observers of the residential real estate market would agree that the growth of the Multiple Listing Service, known as the MLS, is the most significant development in the industry in this century. The MLS represents a procedure whereby individual agents, competitors on listings of houses as well in acquiring buyers, jointly market each other's houses. Homeowners listing their houses with brokers that belong to the MLS are assured that the exposure level will be much higher than if just one agent listed the house. Likewise, buyers no longer need to visit numerous brokers' offices to search the market;

each MLS agent can show the buyer all potentially attractive houses. In the United States, over 90 percent of all homes sold through brokers are handled via MLS.

The standard thinking on MLS is that it represents an unambiguous "good" to society. The National Association of Realtors argues that an MLS is an information service used to expedite brokerage. Certainly, information is improved and consumer search costs lowered. However, the effect on pricing is not as easily discerned. In fact, early industry promotions of MLS systems make a point of emphasizing not only the marketing aspects of an MLS, but also the possibility that the MLS could be used as a vehicle to raise commissions (FTC, 1983). The continued monitoring by antitrust authorities, as well as the actual filing of antitrust suits reflects the widely shared feeling that a MLS may act as some form of anti-competitive trade association. Commenting on the observed uniformity of commissions, Zumpano and Hooks (1988) note that "The recent FTC report, as did earlier studies, attributes such pricing behavior to the cooperative and interdependent marketing arrangements provided by local multiple listing services" (page 13).

The economic literature on the effect of an MLS on a residential real estate market has not been conclusive. Yinger (1981) and Wu and Colwell (1986) present models that consider in some detail the process of broker-buyer-seller links. These models are both search/matching models with uncertainty. Yinger concludes that, absent any market power effects, an MLS will lead to a decline in commission fees. This follows from the fact that search costs drop and this is, in effect,

passed on. Wu and Colwell, using a more extensive approach to modeling the market, find more ambiguous results. They are unable to make hard predictions as to the final effect of an MLS on equilibrium commissions.

This paper will construct a model that demonstrates supercompetitive prices by rivals acting noncooperatively. In order to get to the heart of the matter of commissions, the buyer-seller matching problem will be suppressed. We will, instead, use a general form for market transactions, one that incorporates the findings of the search/match literature. Increases in marketing effort will lead to a reduction in the expected time needed to find a suitable match. Our methodology will be to explicitly consider commissions in such a model.

The model will consider a two-stage game wherein prices are set in the first period and marketing effort occurs in the second period.³ In an earlier insightful work, Bernhein and Whinston (1985) demonstrate how firms may find it beneficial to deal with a common agent in handling industry-wide marketing. In their model, firms effectively "sell" their product to a single, common agent that then sells to the customer. They impose "competition" on this "monopolistic" agent by forcing zero profit rules. The result is an equilibrium where the marketing agent chosen will pay individual firms the cooperative value for the product. Thus the firms set value at the joint maximum. This can be thought of as a variation of the vertical integration literature. The firms set up one more stage in the production process and let this "pure marketer" deal with the customers. An equilibrium then arises wherein each firm sells the product at a quantity-price pair

equalling the joint profit ("monopoly") maximum and the buyer (the "competitive" retailer) pays this monopoly price for the product and passes it on to final purchasers.

In the present work, the individual firms do not set up a unique (but competitive) marketer. Rather, they contract with each other to undertake joint marketing efforts. The paper is organized as follows. The next section will present an examination of the residential real estate market in general terms, before and after the introduction of the MLS. Here, it will be demonstrated that the mirror image of the usual Bertrand-Nash outcome holds: price is bid up (possibly as far as the monopoly level) rather than down to cost. The following section will offer an example with slightly differentiated products (houses). Here, as in the standard Bertrand model, the differentiation tends to dampen the degree of price competition. However, it is still the case that the MLS unambiguously leads to higher commissions charged for brokerage services. This section is followed by a discussion of the membership decision. Finally, the conclusion will offer some caveats and suggestions for future research.

II. THE MODEL

This section will attempt to describe an urban residential real estate market. The market is comprised of numerous buyers and sellers whose transactions are facilitated by intermediaries: real estate agents.

In order to provide the clearest view of the effects of the MLS on real estate agent behavior, we will use a very simple model. In

their role as intermediaries, real estate brokers can be thought of as one stage in the vertical production process. Homeowners, or housing contractors, are the "manufacturers" and brokers are the "retailers" in the language of the traditional vertical integration literature.⁴ The brokerage process involves the "purchase" of the house by the agent; the agent subsequently sets the commission and the house is marketed. That is, the broker buys the inputs (houses) from upstream producers (the homeowners). We assume that the owner's asking price is determined by a competitive process, allowing us to concentrate on the formation of optimal brokerage fees (commissions).

In specifying the supply curve for houses, we are immediately faced with the complication that houses are, of course, differentiated. While prices may be correlated with square footage, for example, it is easy to imagine several houses with identical size but widely differing prices. To avoid this complication, we concentrate on a single class of house, the ubiquitous \$100,000 house.⁵ We assume that the supply of such class of houses is perfectly elastic at that price. As such the sellers asking price, P_H , can be treated as parametric to the problem: P_H is fixed at $\bar{P}_H$. Additionally, we make a specific assumption about the form of the broker's commission. The choices are "flat fee" versus "percentage of sale." In order to reflect the institutional details of a typical real estate market, the latter method is used. However, it should be pointed out that this is not an unreasonable assumption. The traditional principal agent literature has demonstrated the advantages of such a compensation scheme in a bilateral agency relationship (Harris and Raviv (1979)).

These assumptions imply that the full price of a house, ρ_i , can be written as:

$$\rho_i = (1+p_i)\bar{p}_H$$

where p_i is the commission charge. The first part of this section will consider the workings of such a housing market in the absence of an MLS. This will provide us with a benchmark to use in comparison with the results of the second part where an MLS is introduced.

A. The Market Without Multiple Listing Services

Consider a real estate market with many buyers and sellers of houses. These houses are sold through intermediaries in a well established brokerage market.⁶ The real estate agents A_i ($i=1, \dots, N$) provide a service to sellers and buyers in providing information. Each agent charges a fee for performing this service. This fee (commission) is chosen to maximize the agent's profits given costs and rival firm behavior.

The general form of demands can be written as follows: The number of houses sold by agent i is

$$(1) \quad q_i = f(\rho_i, \underline{p}_j)$$

where ρ_i is own price, $\underline{p}_j$ is the vector of prices of all rival sellers and $f_1 < 0$, $f_2 \geq 0$. This last restriction allows the various houses to be substitutes.

As mentioned earlier, several authors have modeled the housing sale transaction through search/matching methodologies. There, an

increase in marketing effort leads to an increased probability of getting a match between the buyer and the seller. However, the timing issue is effectively ignored. Our approach will be similar, with direct emphasis placed on the issue of the length of time it takes to move the house. Each house is sold under uncertainty in the form of an unknown date of sale. Specifically, each firm invests a certain amount of marketing expenditures, m_i , at time $t=0$. This expenditure will lead to an expected sale date τ according to the cumulative distribution function $H(t,m)$ corresponding to

$$\int_0^t h(\tau,m)d\tau$$

where $h(\tau,m)$ is the pdf indicating the probability that the house will be sold at time τ given expenditure m . This function is increasing in m . That is, the expected "time on the market" is a decreasing function of the amount of marketing effort devoted to the house in question.⁷

The agent's cost is a function of the number of houses sold. We assume that the cost function can be written as:

$$(2) \quad C_i(q_i) = \bar{P}_H q_i + c_i q_i + m_i q_i + F_i$$

Included in the fixed cost term are the overhead costs of operation as well as acquisition costs: $c_i q_i$ represents the cost of completing (closing) the sale, the same to agents of sellers as to agents of buyers; $m_i q_i$ refers to the cost of marketing each house, assumed constant; and $\bar{P}_H q_i$ represents the supply price of the housing stock sold by agent i .

Each agent must choose price to maximize discounted expected profits on the sale. The equilibrium concept imposed will be a simple noncooperative Nash game in prices. This Bertrand-Nash equilibrium will be a set of strategies among the N agents where each firm's optimal strategy is the behavior that maximizes expected firm profits. Profits can be written as:

$$(3) \quad V_i = \int_0^{\infty} (\rho_i - c_i - \bar{P}_H) q_i(\rho_i, \rho_j) h(t, m) e^{-rt} dt - m_i q_i(\rho_i, \rho_j) - F_i$$

where r is the common discount rate. Equation (3) is written to reflect the fact that revenues, closing costs and housing stock purchase prices are not incurred until the (uncertain) time of sale. Marketing costs, $m_i q_i()$, are up-front. In the absence of collusion, each agent will choose a price which maximizes (3) given his rival's behavior. Through standard procedures, one can derive the Bertrand reaction functions and the non-cooperative equilibrium prices, ρ^N .

B. The Multiple Listing Service

The results of the above section indicate that Bertrand-Nash competitors will find the non-cooperative price in a manner exactly the same as traditional Bertrand models: simultaneous solution of the N best response functions. In this section, the game will be changed somewhat. The introduction of cooperative marketing, the MLS, implies a change in the incentive structure faced by real estate agents: the introduction of second stage (the marketing period) to the game. In part A above, the agent chose price and marketed his house. Now the agent must choose price with the knowledge that the total marketing level devoted to the house will be dependent on this price.

Essentially, an MLS offers the opportunity to greatly increase the number of agents marketing any particular listing. The institutional characteristics are important enough to warrant further explanation. Suppose all assumptions from part A above follow. Once again, agent i sells q_i which is a function of own price and rivals' prices. If agent i is a member of the MLS, then each house is now available to be sold by any agent that is also a subscriber (member) of the organization. That is, the marketing level is now a function of the many agents' efforts. Let $M \in N$ be the set of agents j that market agent i 's house; each agent j can invest an amount of marketing effort, denoted m_j , on agent i 's house. To simplify we let $m_i = m_j = m$. This assumes that the marketing effort is either nil or, if positive, equal to some constant level independent of the identity of the symmetric real estate agents. Think of it as follows: each agent picks a path toward selling the unit (house) and each path is assumed independent with identically distributed. In order to attract this marketing effort, agent i must offer agent j some form of compensation for agent j 's effort in the q_i transaction. As compensation, we assume the agent that "wins" (i.e., the agent that finds the buyer) splits the commission evenly with the listing agent. This 50-50 split is, indeed, the predominant arrangement in the real estate industry.⁸

Now the expected time on the market will be much different. Each rival interested in marketing the house will invest m , giving that agent an equal shot at finding the buyer first. This reduces the probability that i will be the "winning" marketer but also compresses the time until sale. Formally, if we let τ represent the time of

sale and let K represent the total number of agents showing the house (the listing agent plus the $K-1$ rivals), the probability that i finds a buyer before one of the $(K-1)$ rivals is written:

$$\text{Prob}(\tau_i < \tau_K) = h(\tau, m)(1-H(\tau, m))^{K-1}$$

Likewise the probability that one of the $(K-1)$ rivals will find a buyer before the listing firm i can be written:

$$\text{Prob}(\tau_K < \tau_i) = (K-1)h(\tau, m)(1-H(\tau, m))^{K-1}$$

Expected profits are now transformed into two parts: the expected profits from an agent's own sales and those from sales of the agent's houses by other members of the MLS.

$$(4) \quad V_{\text{MLS}} = \int_0^{\infty} (\rho_i - c_i - \bar{P}_H) q_i h(\tau, m)(1-H(\tau, m))^{K-1} e^{-rt} dt - m q_i - \hat{F} \\ + \int_0^{\infty} \frac{1}{2} (\rho_i - c_j - \bar{P}_H) q_i (K-1) h(\tau, m)(1-H(\tau, m))^{K-1} e^{-rt} dt$$

where $\hat{F} > F$ now includes the non-zero membership fee into the MLS.

In this environment, the market has a decidedly different characterization. Before, the individual agents simply announced prices, marketed at level m and the noncooperative solution held. In the present case, the game is composed of two stages. In the first stage, each agent offers a package of houses to the MLS.⁹ These houses can be sold by any agent (including agent i) for the announced compensation.

In the second stage, each agent in the MLS examines the listing of possible houses and decides which houses to market. That is, each

agent chooses a subset of the total houses and expends effort m in exposure of this house to potential buyers. After this stage is completed, all variables, prices and exposure levels, are known and the equilibrium is achieved.

Again using Bertrand-Nash as the equilibrium concept, consider the firm's optimal behavior. In this two stage game, the proper way to consider choices is to start from the second stage and work backwards. From the appropriate stage 2 price node, marketing effort decisions are made and the appropriate payoff is determined. Thus, the agents are able to "see" how their price vectors will translate to marketing responses in the second stage.

Consider the effort spent on any agents' housing stock. As in all Bertrand games, an allocation rule must be invoked. In this case, the allocation is not over quantities; rather it is the determination of joint marketing expenditures. Let V_r refer to the discounted expected profits to any rival firm j from selling firm i 's houses. Then

$$(5) \quad V_r = \int_0^{\infty} \frac{1}{2} (p_i - c_j - \bar{p}_H) q_i h(t, m) (1 - H(t, m))^{K-1} e^{-rt} dt - mq_i$$

is the expected profits to rival j if the rival chooses to market agent i 's houses.

To complete the model, we need to determine K^* , the number of rivals that will actually market agent i 's house.¹⁰ Competition in marketing will attract additional brokers until expected profit is driven to zero. Defining K^* as this breakeven level, we have:

$$(6) \quad V_r = \int_0^{\infty} \frac{1}{2} (p_i - c) q_i h(t, m) (1 - H(t, m))^{K^*-1} e^{-rt} dt - mq_i = 0$$

Since entry into an MLS entails positive fees (membership costs) agents will become members of the MLS only if they receive benefits (joint marketing) from this organization. That is, each member will price so as to encourage cooperative marketing.

The result is the mirror image of the conventional Bertrand-Nash game with differentiated products. In that game, the individual firm i sees reduced profits if $p_i > p_j$. In the present game, agents are not trying to lure customers, desirous of lower prices, but are after marketers, desirous of more attractive compensation. Certainly, agents still understand the quantity impact of any price change, up or down. However, imagine the agents are at the Bertrand/Nash equilibrium described in the previous section; now introduce the joint marketing aspects of the MLS. The previous equilibrium price, determined on the basis of demand and competition, will no longer be optimal as there is a (unilateral) gain from joint marketing realized when the agent attracts such help. That is, a new "marginal benefit" to increasing price has been added to the incentive structure.

The fact that agents are willing to pay to belong to the MLS is evidence that they will price so as to gain from the added exposure. The competitive return generated in the non-MLS scenario will not attract any exposure from other MLS agents. The Bertrand solution to (4) and (5) is, in this general form, quite messy. It is clear that prices in this MLS game will be higher than those where the joint marketing impact of pricing decisions is not felt. In fact, given sufficient conditions, the outcome could approach the monopoly, or fully collusive price, analogous to the fact that some conditions,

constant marginal costs and homogeneous products, cause the standard Bertrand solution to degenerate to the competitive price. In order to better demonstrate the equilibrium, the next section gives some form to the probability functions as well as the demand curves.

III. AN EXAMPLE ECONOMY

In this section, we will impose some structure on the model in an attempt to convey more of the intuition of the result. First, consider the probability functions. Let $\mu(m)$ be the marketing production function, mapping the marketing effort m to exposure levels. We assume the cumulative density function can be written:

$$H(t,m) = 1 - e^{-\mu(m)t}$$

which implies that the pdf is

$$h(t,m) = \mu(m)e^{-\mu(m)t}$$

and the expected date of sale, $E(\tau)$ is then just $1/\mu(m)$. For notational simplicity, we also assume closing costs are symmetric across firms: $c_i = c_j = c$.

Case 1: The No-MLS Case

Expected profit for firm i (equation (3)) can be written:

$$V_i = \int_0^{\infty} (\rho_i - c - \bar{P}_h) q_i \mu(m) e^{-(\mu(m)+r)t} dt - mq_i - F$$

This reduces to

$$(7) \quad V_i = \frac{R_i \mu(m)}{\mu(m)+r} - mq_i - F$$

where $R_i = (p_i \bar{P}_H - c)q_i$. For the remainder of this section, normalize $\bar{P}_H = 1$.¹¹

Case 2: The MLS Case

Equation (4) is the relevant expected profit term. It is now written (letting R_i again refer to $(p_i - c)q_i$)

$$V_i = \int_0^{\infty} R_i \mu(m) e^{-(K\mu(m)+r)t} dt - mq_i - \hat{F} \\ + \int \frac{1}{2} R_i (K-1) \mu(m) e^{-(K\mu(m)+r)t} dt$$

or

$$(8) \quad V_i = R_i \left(\frac{\mu(m)}{K\mu(m)+r} \right) \left(1 + \frac{1}{2} (K-1) \right) - mq_i - \hat{F}$$

Note, in this case, the expected date of sale is now $1/K\mu(m)$. Equation (8) can be further simplified to the specification

$$(9) \quad V_i = R\delta(K) - mq - \hat{F}$$

where $\delta(K) = \mu(m)(K+1)/2(K\mu(m)+r)$.

At this point, two observations are helpful. First, note that $\delta(1) = \mu(m)/(\mu(m)+r)$. That is, (9) is equal to (7) in the case of no rival joint marketing. Secondly, consider the impact of additional marketing on expected profits. Note that $\partial \delta / \partial K > 0$ only if $r > \mu(m)$. The intuition is that an individual agent will desire marketing help, ceteris paribus, the higher is the agent's discount rate or the lower the individual probability of selling the house (the less effective is the individual marketing production function). For our purposes,

we will consider only such cases where $r > \mu(m)$. If $r \leq \mu(m)$ then $\partial \delta / \partial K$ is always nonpositive, implying additional marketers lower expected profits to the listing agent. Clearly, no firm would pay $\hat{F} > F$ to belong to the MLS in such an environment.

Equations (7) and (9) allow us to derive the Bertrand reaction function without and with an MLS respectively. However, in order to explicitly determine the equilibrium, one last bit of structure must be imposed: we need some explicit functional form for buyer demands.

Consider the differentiated oligopoly proposed by Shubik and Levitan (1980). This model posits a simple quadratic utility function in goods and has the added feature that the resulting demands are linear. Both substitutes and complements are possible but we will consider only the former case. This form of demand, allowing some differentiation in products, is necessary to produce non-trivial results. That is, there is no graphical depiction of the Bertrand reaction functions in the case of homogeneous goods.

Using this quadratic form for utility, it is straightforward to determine that demand for agent i 's output is written:

$$(10) \quad q_i = \frac{1}{N} \left(\alpha - p_i - \gamma \left(p_i - \frac{1}{N} \sum_{j=1}^N p_j \right) \right)$$

where $\gamma > 0$ to denote that rivals' houses are substitutes.¹² Given this demand specification, we can determine the explicit form of the reaction functions. The form will be, as indicated by the profit functions (7) and (9), dependent upon the existence of the MLS.

Case A: Bertrand Equilibrium Without An MLS

Recalling, expected profit is written

$$V_i = \frac{p_i q_i^{\mu(m)}}{\mu(m)+r} - m q_i - F$$

where the constant cost term c , symmetric across firms, has been suppressed. There are N firms in this differentiated duopoly.

Consider a single player, firm 1, versus all his rivals:

$$(11) \quad V_1 = \left(\frac{\mu(m)}{\mu(m)+r} \right) p_1 \left(\alpha - p_1 - \gamma p_1 + \frac{\gamma}{N} p_1 + \frac{\gamma}{N} \sum_{j \neq i}^N p_j \right) / N \\ - m \left(\alpha - p_1 - \gamma p_1 + \frac{\gamma}{N} p_1 + \frac{\gamma}{N} \sum_{j \neq i}^N p_j \right) / N - F$$

Since, in any equilibrium, each identical agent will face the same constraints and have the same incentives, we can model the $(N-1)$ rivals as a single player charging p_0 . That is the same as assuming all of firm 1's rivals are charging identical prices, p_0 , implying $\sum_{j \neq i}^N p_j = \left(\frac{N-1}{N} \right) p_0$. Maximizing (11) with respect to p_1 allows us to determine the form of the reaction function for firm 1 in the case of independent marketing:

$$RF_I(p_0) = p_1 = \frac{(\alpha + p_0 \gamma \frac{N-1}{N}) \frac{\mu(m)}{\mu(m)+r} + m(1 + \gamma \frac{N-1}{N})}{2(1 + \gamma \frac{N-1}{N}) \frac{\mu(m)}{\mu(m)+r}}$$

or

$$(12) \quad RF_I(p_0) = p_1 = \frac{\alpha + p_0 \gamma \frac{N-1}{N}}{2(1 + \gamma \frac{N-1}{N})} + \frac{m(\mu(m)+r)}{2\mu(m)}$$

Through similar derivations, one could arrive at the reaction function for the rivals, p_0 . In both cases, due to the substitutability of the products, these reaction functions, depicted in Figure 1, are increasing in rivals price. Solving the reaction functions generates the following equilibrium price, quantity pair:

$$p^* = \frac{m(r+\mu(m))(1+\gamma \frac{N-1}{N}) + \alpha\mu(m)}{\mu(m)(2+\gamma \frac{N-1}{N})}$$

and

$$q^* = \frac{(1+\gamma \frac{N-1}{N})(\alpha\mu(m) - m(r+\mu(m)))}{N\mu(m)(2+\gamma \frac{N-1}{N})}$$

This noncooperative equilibrium is, of course, the point E_0 in Figure 1.

Case B: Bertrand Equilibrium Under an MLS

Here, agents pay a fee to join the MLS and are offered joint marketing efforts by fellow MLS agents. Expected profit (9) can now be written:

$$\hat{V}_i = p_i q_i \delta(K) - m q_i - \hat{F}$$

Recalling that the number of co-marketers, K , will be determined by the expected profits to rival agents j arising from marketing firm i 's houses, define $K^* = \{K | V_r = 0\}$. Now, from (5) we know V_r . By substituting in the demand equation (10) and setting $V_r = 0$, we can derive the value of K which drives expected profit to the marginal co-broker to zero:

$$K^* = \frac{\frac{1}{2} p_i^{\mu(m)-mr}}{\mu(m)m}$$

which results in

$$(13) \quad \delta(K^*) = \frac{\frac{1}{2} p_i^{\mu(m)-m(r-\mu(m))}}{p_i^{\mu(m)}}$$

Inserting (13) and (10) into (9), we can once again consider firm 1 against its various rivals, lumped under the name "firm" 0. Solving for the appropriate p_1 given p_0 , we find a reaction function under the existence of the MLS, $RF_M(p_0)$:

$$(14) \quad p_1 = \frac{\alpha + p_0 \gamma \frac{N-1}{N}}{2(1 + \gamma \frac{N-1}{N})} + \frac{mr}{\mu(m)}$$

It is straightforward to solve for the equilibrium, denoted as $\hat{p}^*$, $\hat{q}^*$

$$\hat{p}^* = \frac{2mr(1 + \gamma \frac{N-1}{N}) + \alpha \mu(m)}{\mu(m)(2 + \gamma \frac{N-1}{N})}$$

and

$$\hat{q}^* = \frac{(\alpha \mu(m) - 2mr)(1 + \gamma \frac{N-1}{N})}{N\mu(m)(2 + \gamma \frac{N-1}{N})}$$

This equilibrium is depicted by the intersection of $RF_M(p_1)$ and $RF_M(p_0)$ in Figure 2.

Of crucial importance to this research is the comparison of the reaction functions and equilibria under the two scenarios. Let $RF_I(p_0)$ denote the reaction function of firm 1 when all agents are independent and $RF_M(p_0)$ denote firm 1's reaction function when all agents belong to the MLS. All else being equal, we can then compare

these two best response functions. Comparing the optimal price under a MLS to the one in a market without joint marketing efforts, we find

$$(15) \quad \hat{p}_1^*(\text{MLS}) = p_1^*(\text{No-MLS}) + \frac{m(r-\mu(m))(1+\gamma \frac{N-1}{N})}{\mu(m)(2+\gamma \frac{N-1}{N})}$$

Scrutiny of the final term in (15) indicates that as long as $r > \mu(m)$, the price under MLS will be strictly greater than the price in a market without MLS. However, we know that $r > \mu(m)$ is the condition necessary to make $\partial \delta / \partial K > 0$. Thus, if agents find it useful to join the MLS, the new best response functions change and equilibrium price rises. These new reaction functions are depicted along with the old ones in Figure 2. At E_1 , the MLS equilibrium, agents charge a higher price than at E_0 , the original, independent broker equilibrium.

The purpose of this section has been to offer diagrammatic exposition of the ideas presented in Section II. Here, to avoid the untractable nature of the general Bertrand price solution in the case of substitutes, we have considered an explicit functional structure. The results are the same: the possibility of outside firm aid in sales effort, dependent on the price offered, leads Nash-Bertrand players away from the noncooperative price.

IV. THE MEMBERSHIP DECISION

Before closing, it is important to consider the decision by an agent to join an MLS in the first place. Nearly all residential housing markets are characterized by coexistence of MLS and non-MLS real estate agents. The purpose of this section is to explicitly

consider this situation in terms of the model just presented. That is, it is important to consider how such an equilibrium can arise. Obviously, absent membership constraints, the only equilibrium involves equalization of marginal profits.

Fortunately, the groundwork for such an analysis has been provided by Deneckere and Davidson (1985) in their paper on coalition formation. While they dealt explicitly with mergers, it is possible to consider the extension to the present case.

Let the total number of agents N be divided, arbitrarily, into two sets, $\{I\}$ and $\{N-I\}$ and let the subscripts $i \in I$ and $j \in N-I$ denote into which group an agent falls. As a starting point, each agent acts non-cooperatively without an MLS. Then, the reaction functions as in Figure 1 are representative. $RF_I(p_1)$ denotes the reaction function of those agents $i \in I$ and $RF_I(p_0)$ denotes the reaction function of the group $j \in N-I$.¹³ Now consider the introduction of an MLS and let all agents $j \in N-I$ become members of the MLS. (Again, for the moment, let me arbitrarily take agents i and leave them independent and take agents j and put them in the MLS.) Now, the reaction function of a particular member of j , given the MLS, can be solved by holding the price charged by the independent firms $i \in I$ constant at p_0 , and consider the effects of an unrelated change by firm j , given all other $N-I-1$ firms in $\{N-I\}$ will follow in equilibrium. This reaction function is shown by $RF'_M(p_0)$ in Figure 3. This is different than one of the $RF_M(p_0)$ in Figure 2 in that the $RF_M(p_0)$ was calculated given that all other firms will, in equilibrium, also respond with price changes. Now, only a subset $N-I$ of the total N will move similarly.

Significantly, several points are important. First, the equilibrium in Figure 3 occurs at a price pair where those in the MLS are charging more than those outside the MLS. Thus, while independent agents can offer houses at a lower price, they also receive (possibly significant) less marketing exposure.

Secondly, consider the profits involved in the membership decision. It is straightforward, although extremely tedious, to consider profits to $i \in I$ and $j \in N-I$ as the size of each group changes. What is important is to consider the key points of this equilibrium. It is possible to show that the profits to firms $j \in N-I$ are less than those earned by the independent firms $i \in I$ at the new equilibrium point, E. The obvious question is, why would a firm ever join the MLS, given that non-MLS firms earn higher profits? To answer this, let $\hat{I}$, $N-\hat{I}$ be the equilibrium configuration. That is, $N-\hat{I}$ represents the size of the MLS such that gains to the $\hat{M}+1$ member would be less than the membership fee. Per firm profits to members of the MLS are a decreasing function of membership size. Thus, there is an upper bound on the number of firms that will join the MLS. The equilibrium occurs at the configuration I^* , $N-I^*$. Let M^* denote the equilibrium MLS membership size. Then, the equilibrium is characterized by $\pi_j > 0$ for all $j \in \text{MLS}$ but $\pi'_j < \pi_i$ for $i \in I$ and π'_j represents the profit to MLS members when membership size increases by one. Thus, for any configuration with membership roles of size less than M^* , unilateral gains from joining the MLS are positive. Even though those remaining in the $I-1$ set gain more, it is still a dominant strategy on the part of any given agent $i \in I$ to break and enter the MLS if membership is less than M^* .

V. CONCLUSION

The above model offers the interesting conclusion that competitive rivals will price above the noncooperative level. Bertrand players actually compete with each other to attract joint marketing efforts. This competition, brought on by the institution of the MLS, will force firms to offer more attractive partnerships in the individual joint ventures.

Thus, while standard noncooperative Nash games in price result in price being driven down to costs, this analysis finds the opposite. The intuition is clear. Any individual agent i recognizes that marketing efforts by its rivals j on behalf of i 's stable of houses will be made in a second stage--after the announcement of the price vector. Thus, the agent must quote a price which optimally attracts rivals to help sell the agent's houses. The equilibrium price quoted by i will be that price which maximizes the compensation available to j from such interfirm representation.

These results offer evidence in the matter of a policy issue of current concern. Many people have called for the removal of prohibitions against letting the general public have access to the listings on the MLS files. If the general public were permitted such access, there would be a significant drop in the incentive to raise prices. In the polar extreme, if all buyers had access to the MLS, an agent would not need to offer a higher price to attract interfirm marketing efforts. The positive "information" effect of the MLS would still occur but the negative "price" effect would disappear.¹⁴

This analysis has demonstrated, in a very simple framework, how an MLS can result in price increases, a significant finding in itself. However, it points to a further issue of concern. In order to more clearly focus on commissions, the assumption of perfect elasticity of supply allowed us to take the price of housing stock as parametric to the model. In fact, if there is some elasticity of supply in housing stock, the MLS may have an effect on the price of housing, distinct from the commissions charged. Evidence on this issue comes from the Wu and Colwell matching model. They find that the introduction of an MLS will precipitate a rise in the equilibrium price of housing in the market. The question of whether this result follows in the present model is a topic under current investigation.

Of additional interest for future research is the question of how the "split" is determined, as well as how the MLS charges for its services. In the present paper, the MLS charges a fixed fee for membership. However, it is clear that some strategic importance must be in this decision. For example, alternative rules on compensating rival marketers, or two part tariff pricing of MLS membership could have significant impact on the equilibrium.

FOOTNOTES

¹The name "facilitating practice" has been used to describe a variety of conduct patterns. Salop (1986) formalizes the idea as referring to practices that allow information exchange and work to alter the pay-offs from certain forms of behavior.

²Among other sources, Salop (1986) discusses various practices, such as meet or release contracts, most-favored-customer clauses (also analyzed in Cooper (1986)). Holt and Scheffman (1987) consider the effects of different pricing rules.

³This two-stage procedure, set the commission and then the marketing level, is not unique to residential real estate. For example, travel agents market air traffic tickets simultaneously (and in competition) with the various issuing airlines.

⁴Of course, housing contractors could sell their own homes. However, we will not consider such vertical integration issues in the present paper.

⁵Readers in housing markets more active than Champaign-Urbana can instead imagine the ubiquitous \$200,000 house. The key is, of course, to stay away from thin markets.

⁶Again, remember that it is this brokerage market (not the housing market) we now wish to examine in more detail.

⁷Note that price is not considered directly in this distribution of selling time; indirectly, price will enter through its effects on marketing efforts.

⁸The reader will note that an explanation of 50/50 as the equilibrium split is not offered; we merely impose this split as an assumption. Possible reasons include such phenomena as focal point pricing or the result of Nash bargaining between symmetric players.

⁹That is, the agent offers the houses and the prices required to complete the sale.

¹⁰Actually, (K^*-1) rivals are involved. K^* is the total number selling i 's houses, including firm i itself.

¹¹This normalization saves on notational complexities and entails no loss of generality since the supply price $\bar{P}_H$ is constant.

¹²Demand curves of this form, where sales are a function of own price and the difference between own price and average price, are common in models of quadratic utility. Interestingly, Carlson and MacAfee (1983) find similar demand forms in a model of search costs and price dispersion.

¹³Note, these are not group reaction functions. They are the reaction functions of any particular member of a group to an outsider's charge in price.

¹⁴Industry members decry such openings of MLS files on the standard grounds that outsiders would not be able to perform the complex duties of professional brokers. It is true that some changes would be necessary, but they would most likely be minimal. See, for example, the FTC report, pages 124-125.

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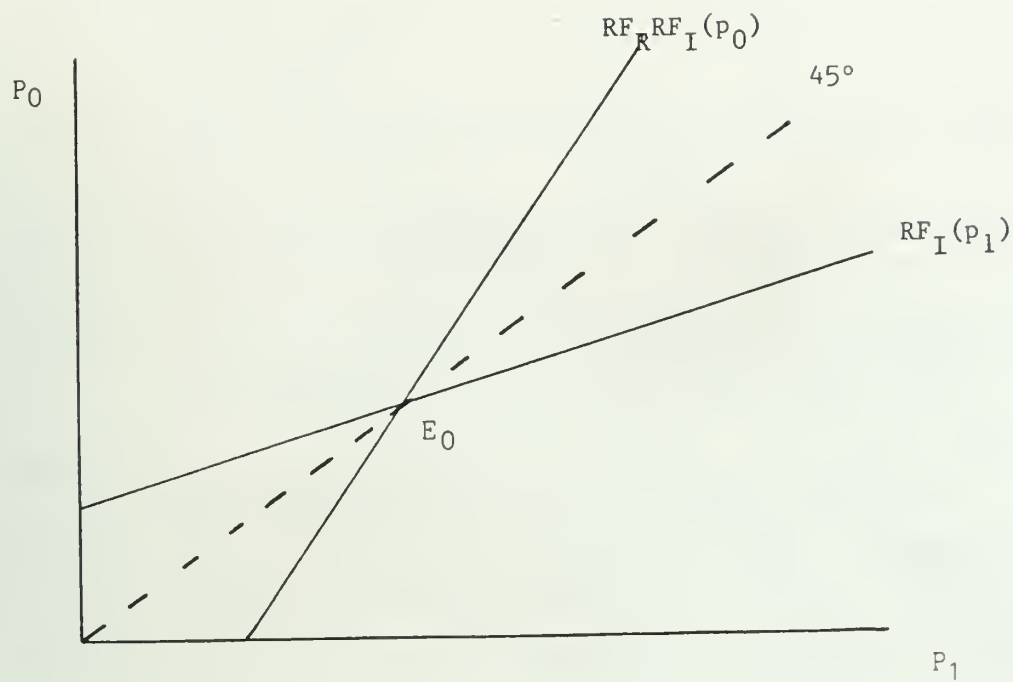


Figure 1.

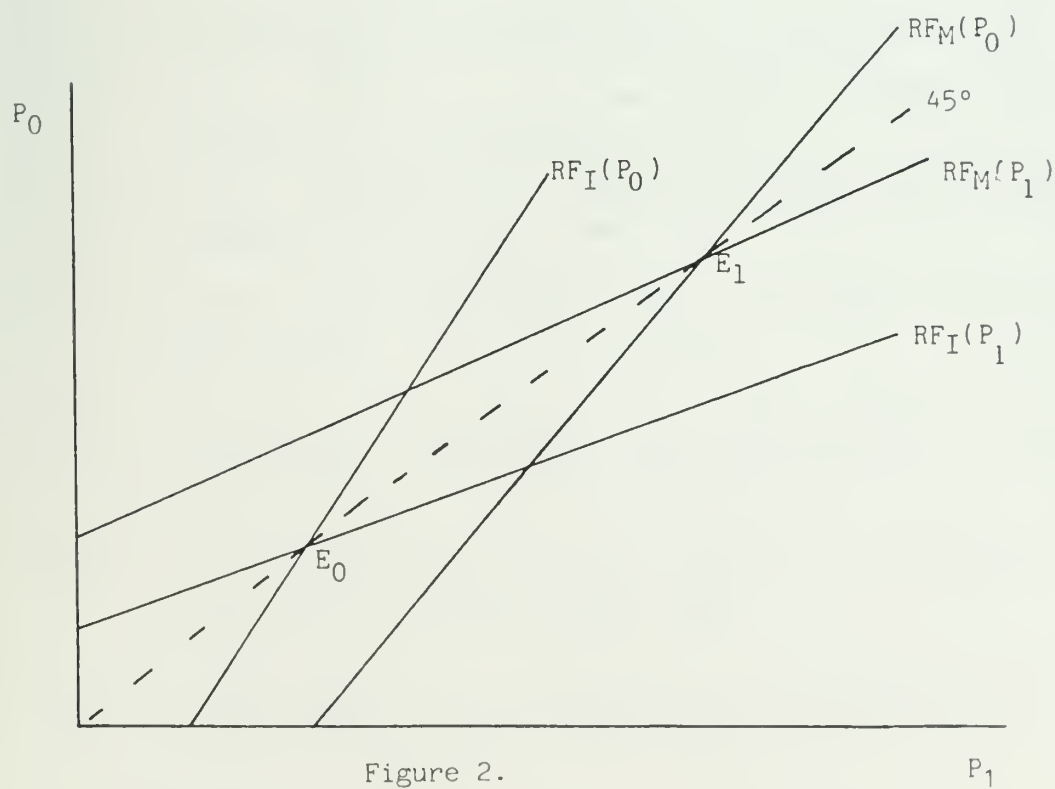
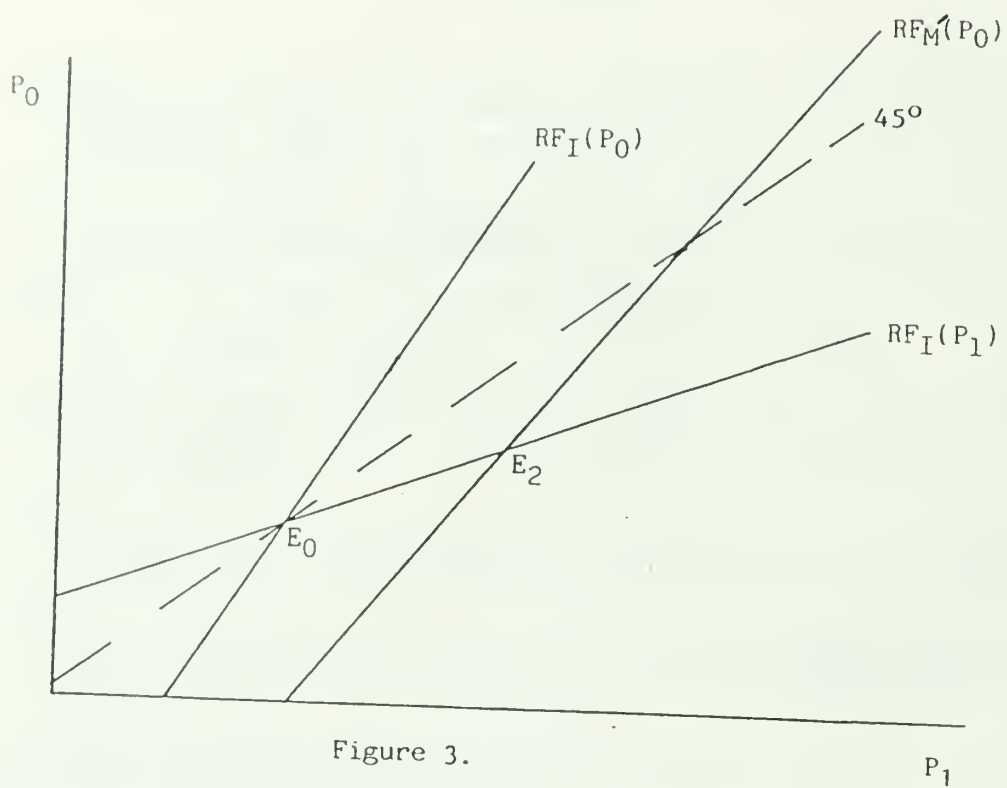


Figure 2.



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